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ABSTRACT

The educational failure of ethnic minority children in the industrialized countries has persuaded some educators of the need to incorporate multicultural perspectives into the mathematics curriculum. All societies have developed mathematical practices appropriate to their daily lives and cultures, an area of mathematics known as "ethnomathematics." Benefits of incorporating students' cultural background into the mathematics program include the following: (1) increased self-esteem on the part of language minority children; (2) increased interest when instruction is related to daily life; and (3) appreciation of different ways of thinking. Impediments to combining multicultural aspects with the mathematics curriculum include the following: (1) lack of materials, (2) inadequate teacher training; (3) stereotypic views of what constitutes a "proper" curriculum; and (4) overemphasis on student performance on standardized tests. A list of 11 references and an illustration of an African sand drawing are also included. (FMW)

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INTEGRATING MATHEMATICS WITH THE STUDY OF CULTURAL TRADITIONS

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INTEGRATING MATHEMATICS WITH THE STUDY OF CULTURAL TRADITIONS

In my talk today I will discuss the multiculturalization of the mathematics curriculum, in particular at the elementary and middle grade level. Usually I include slides of beautiful works of art and architecture from many parts of the world and many eras in history. The audience is sure to be captivated by the photographs, if by nothing else in my talk. Today there is no time for pictures, and I shall try to win you over with my talk.

All societies have developed mathematical practices appropriate to their daily lives and their cultures, an area of mathematics now known as "ethnomathematics." Yet very little information about these practices has entered the curriculum at any level.

Children tend to view mathematics as a cut-and-dried, esoteric subject that arose full-blown from the minds of a few white men in the past. Small wonder that many students seem to leave behind them all knowledge of the real world when they enter the mathematics classroom. It should be no surprise that many students find mathematics irrelevant, develop fears and anxiety about the subject, and drop it as soon as possible.

For many years I taught secondary level mathematics in a small school district near New York City, an oasis of integration in the midst of a racially segregated society. The population consisted of professional and other middle class families, mainly white, and working poor, predominantly black families. Known for racial integration of schools and housing, an unusual situation in the 1950s, the district attracted families looking for that environment, including several famous black figures.

Some of our educational practices were innovative for the time, and even for today. Although female students participated in academic mathematics courses to the same extent as males, we had found that many of our students

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were dropping mathematics after fulfilling the minimum requirements. The majority of these dropouts were African-American and working class young people. With the federal funding that was available in the 1960s, several of us in the mathematics department wrote curriculum materials for all high school grades, incorporating hands-on activities and applications that were meaningful to the students. The curriculum included major topics in algebra and geometry, and at the same time afforded students the opportunity to improve their inadequate skills in arithmetic, with topics in statistics, for example. Some topics related to their social studies course, thus making both subjects more meaningful.

The turning point for me came when the district offered a course in African history to the faculty, in response to the growth of African-American interest in exploring their African roots. As my term project I chose to write an essay on the topic I called the sociomathematics of Africa. This proved to be a far more ambitious undertaking than I had anticipated. Very little information was available in libraries in any country. Eventually I was able to gather enough material for a book, Africa Counts: Number and Pattern in African Culture [Zaslavsky 1973, 1979, 1984], still the only book of its kind, now available in hardcover and in paperback in English, and in a beautiful Hungarian edition. A tremendous contribution to the book came from University of Wisconsin professor D. W. Crowe, an early participant in the United States-sponsored group organized in the early sixties to fashion a modern mathematics curriculum for African countries. Dr. Crowe had amassed a wealth of mathematical materials based on indigenous African practices--house construction, games, repeated patterns in art, to mention just a few. With typical cultural arrogance, the group rejected his contributions. Subsequently I was the fortunate recipient of these materials.

Several years later, E. G. Begle, chair of the School Mathematics Study Group, one of the most prominent and influential new mathematics programs in the United States, wrote [1969]:

> The question arises as to what are the effects of the culture in which a student is brought up on his ability to learn and do mathematics. A related question is whether pedagogical procedures that are effective in one culture will be equally effective in another culture ...I might also point out that the problem is not one for the United States alone. Many countries are asking not only the United States but others of the affluent countries for assistance in improving their mathematics education programs. Having looked into a number of attempts to honor these requests, I am convinced that failure to study the cultural milieu of the proposed reforms has often resulted in a serious waste of time, effort, and money.

When I was writing my book, I had in mind an American audience, and I used many of the themes with both teachers and students. But I was amazed and gratified to learn that African scholars were also interested in the book.

Mathematics educators in African and other developing countries now recognize the need to multiculturalize the mathematics curriculum [D'Ambrosio 1985, Gerdes 1985]. But the Third World exists even in the First World, certainly in the United States. Our cities house scores of different ethnic groups, each with its own culture. In the New York City public schools are children speaking over fifty different languages, and in Los Angeles the variety is even greater. Black and Hispanic young people, particularly from low income families, take fewer mathematics courses and score far lower on standardized tests, than do white students, although they are just as capable. Witness the recent film "Stand and Deliver," the true story of Garfield High School in East Los Angeles, where more students take college-level calculus than in all but a half-dozen schools in the entire country. Almost 90% of these students are

from low-income Hispanic families [Bennett 1987]. So it can happen! But we must find ways to appeal to a diversity of cultural backgrounds and learning styles, rather than to dismiss these students as incapable of learning.

The educational failure of ethnic minority children in the industrialized countries has persuaded some educators of the need to incorporate multicultural perspectives into the mathematics program [Bishop 1987]. Indeed, all children profit from such an expansion of the curriculum. Children learn that mathematical practices arose out of the real needs and desires of all societies. Mathematics comes alive when children study the measurement and numeration systems, the patterns in art and architecture, the games of skill and games of chance of various cultures. Students have the opportunity to learn about mathematical contributions of women and of Third World societies, a generally neglected area of mathematics. They can take pride in their own heritage, and at the same time become familiar with and learn to respect the cultures of other societies.

For the past fifteen years I have been conducting seminars and workshops for teachers on the theme: "Bring the world into the mathematics class" [Zaslavsky 1973, 1985, 1987]. The participants are encouraged to explore the mathematical practices of their own students' cultures, and to integrate these practices into the mathematics curriculum. Wherever feasible, they coordinate mathematics with other subject areas. They develop activities based on real life problems, activities that challenge students' curiosity and reasoning powers. Both teachers and students begin to realize their own power as they work together to organize classroom procedures, control the curriculum, and construct their knowledge.

I will relate a few typical outcomes at different age levels.

1. Language-minority children often feel inferior

because of their inability to speak the language of the country. However, given the opportunity to count in their own language, to teach the number words to their classmates and even to the teacher, and perhaps to explain the structure of the numeration system, their self-esteem grows immeasurably.

2. In a session on the topic of mathematical probability, the participants (teachers) discussed the tossing of coins, dice, cowrie shells, half-shells of nuts, and other objects appropriate to various societies. After they had carried out experiments with some of these devices, a first grade teacher in the South Bronx, the poorest and most neglected area of New York City, decided to introduce the subject to her students. According to her plan, she would explain "head" and "tail" of a coin, then toss one coin, and so on. To her surprise, the children, with their streetwise experience, knew all about tossing coins, and entered enthusiastically into the activity.

3. A project dealing with the shape of a house [Zaslavsky, in press] involved finding the areas of several different shapes, all having the same perimeter, by sketching the shapes on grid paper and counting the squares enclosed by each shape. As an aftermath to this activity, one class, working in small groups, designed, constructed and decorated several African-style compounds of round houses with conical roofs. In the course of this activity they learned that a cylinder is a rectangle whose two opposite edges have been joined, and that a cone is a circle with a sector removed. Another class used rulers, tape measures, and lengths of string to find areas and perimeters of many objects in the classroom.

4. In response to a unit on African sand drawings, an aspect of graph theory, one ninth grade student commented: "I loved the fact that I got a chance to learn some of the math from a completely different country." Another said: "It showed that we shouldn't think our way

of doing math is the only way there is." Ironically, the most talented mathematics student in that class wrote: "The traceable networks are nice for recreation, but they aren't real mathematics." To him, real mathematics meant the standard academic curriculum.

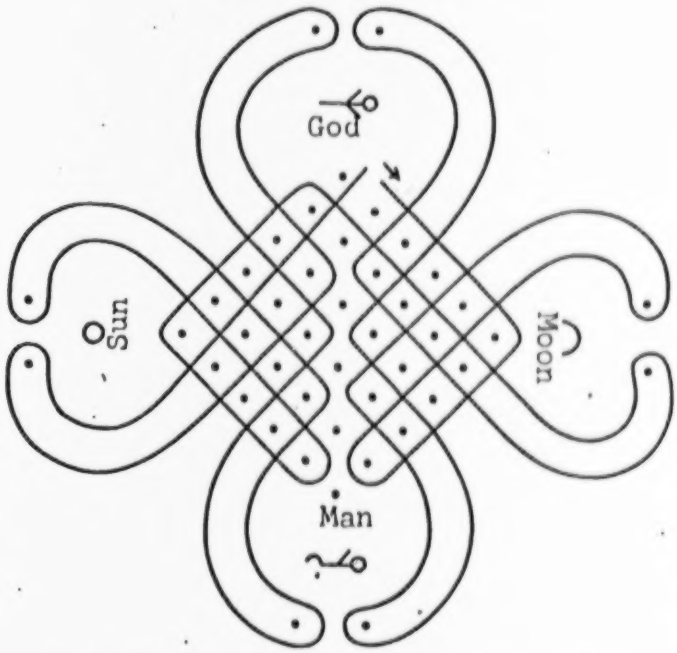
5. Several teachers at various grade levels are including mathematics in their study of apartheid in South Africa and racism in the United States [Zaslavsky 1986].

6. An Afro-American teacher wrote a paper about black children's exposure to number concepts through the illegal lottery known as the "numbers game." She described the use of probability, the skill of semi-literate people in recalling and recording numbers, and the system of hand gestures used when the police were on the scene. In conclusion she wrote: "Certainly if teachers could in some way use some of this number logic with the children, or at least recognize their familiarity with numbers when they meet them, perhaps number games based on Playing the Numbers might be substituted for the boring activities now presented to the children" [quoted in Zaslavsky 1975].

Many obstacles block the implementation of multicultural mathematics education, among them a dearth of materials, inadequate teacher training, and the mania for testing that grips the United States. The most daunting impediment is the conception of proper mathematics education held by some educators and school boards. As an example, one referee, in an evaluation of my article, "Symmetry in American Folk Art" [Zaslavsky, to appear], dealing with patterns in quilts and Navajo (Native American) rugs, both traditional women's art forms, crossed out, with no word of explanation, two complete paragraphs and many phrases. These passages dealt with the affective aspects of these activities. Apparently this referee believes that students' attitudes to mathematics are of no consequence, that motivation plays no part in the learning of mathematics.

A further deterrent to enriching the mathematics curriculum came with the announcement of the results of the 1986 National Assessment of Educational Progress in mathematics. Commenting on the improvement in scores on basic skills, the president of the Educational Testing Service commented: "Thanks to the back-to-basics thrust, we've brought up the students who were at the bottom" [New York Times June 8, 1988:A1]. In other words, children have improved in their ability to carry out computations, a task that can be performed more quickly and accurately by a calculator. At the same time, the test results showed little or no progress on higher-order reasoning abilities. We must continue to ask: "What is mathematics education for?"

Sand drawing
Chokwe (Tchokwe), Angola



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(Cf Gerdes, P. in Educational Studies in Mathematics 19)

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